DEP & DWQI Work to Date on Perfluorinated Chemicals (PFCs)

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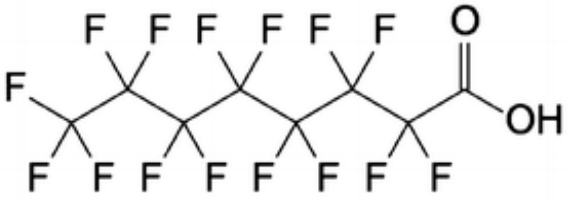
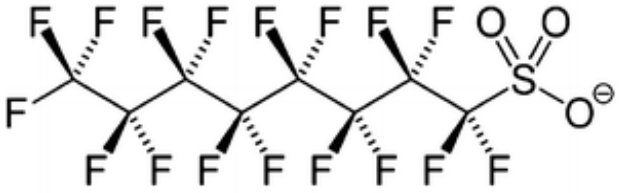
Overview of PFCs as Drinking Water Contaminants

- Group of manmade chemicals.
  - Totally fluorinated carbon chain charged functional group.
  - Carbon chain length varies among compounds.
- Do not break down in the environment.
- Water soluble.
  - Occur in drinking water.
  - Drinking water can be important route of exposure.
- Some have long human half-lives (several years).
- Cause toxicity in animal studies.
- Some are associated with health effects in humans.
  - Including general population and/or communities with drinking water exposure.



Perfluorooctanoic acid (PFOA)



Perfluorooctanesulfonate (PFOS)

Perfluorooctanoic Acid (PFOA, C8)

- PFOA detected at Pennsgrove Water Company, Salem County (now NJ American Ranney Station).
  - Tap water up to 0.064 µg/L (64 ng/L; November 2005), reported to DEP (February 2006).
  - Wells at up to 0.19 µg/L (190 ng/L; February 2006), reported to DEP (May 2006).
  - Also, private wells in the vicinity up to 0.61 µg/L (610 ng/L; 2009 - present).

- New Jersey PFOA guidance - 0.04 µg/L (40 ng/L; February 2007)
  - Developed by DEP Office of Science, in response to Pennsgrove Water Company request to DEP Bureau of Safe Drinking Water (May 2006).
  - Protective for chronic (lifetime) exposure.
  - Based on toxicology studies and endpoints identified in 2005 draft USEPA PFOA risk assessment.

PFOA (continued)

- 2006 DEP Bureau of Safe Drinking Water occurrence study - PFOA & PFOS.
  - 23 NJ public water systems sampled (June-July 2006).
  - Groundwater and surface water sites.
  - Selected for potential susceptibility to PFC/synthetic organic chemical (SOC) contamination and/or geographic diversity.
  - PFOA: 65%; PFOS: 30% ($\geq$ 0.004 µg/L; 4 ng/L).
- DEP report: *Determination of Perfluorooctanoic Acid (PFOA) in Aqueous Samples* (January 2007).
- *Post, G.B., Louis, J.B., Cooper, K.R., Boros-Russo, B.J., Lippincott, R.L. (2009). Occurrence and potential significance of perfluorooctanoic acid (PFOA) detected in New Jersey public drinking water systems. Environ. Sci. Technol. 43, 4547–4554.*
  - Peer reviewed publication (DEP/Rutgers; May 2009).
  - Results of 2006 DEP study, additional PFOA occurrence data, and basis for PFOA drinking water guidance.

PFOA (continued)

- DWQI voted to add PFOA to Workplan for MCL development (January 2009).
- Health Effects Subcommittee reported progress on PFOA evaluation to DWQI (September 2010).
- *Post, G.B., Cohn, P.D., and Cooper, K.R. (2012). Perfluorooctanoic acid (PFOA), an emerging drinking water contaminant: a critical review of recent literature. Env. Res. 116, 93-117.*
  - Peer reviewed publication (DEP/DOH/Rutgers; May 2012).
  - Review of relevant PFOA literature:
    - Environmental occurrence and fate, human exposure sources and serum levels, toxicokinetics, health effects (human and animal), mode of action.
- Update of PFOA review is needed to include many new studies published since 2012.

2009-2010 DEP Bureau of Safe Drinking Water Study of 10 PFCs in NJ Public Water Systems (PWS)

- Raw water from 31 public water systems in 20 of 21 NJ counties.
  - Sampling: July 2009 – February 2010.
  - Ground water and surface water sites.
  - Chosen for geographic diversity.
- PFCs analyzed:
  - Seven carboxylates (C4-C10):
    - *Perfluorobutanoic acid (PFBA, C4)*
    - *Perfluoropentanoic acid (PFPeA, C5)*
    - *Perfluorohexanoic acid (PFHxA, C6)*
    - *Perfluoroheptanoic acid (PFHpA, C7)*
    - *Perfluorooctanoic acid (PFOA, C8)*
    - *Perfluorononanoic acid (PFNA, C9)*
    - *Perfluorodecanoic acid (PFDA, C10)*
  - Three sulfonates (C4-S, C6-S, C8-S)
    - *Perfluorobutane sulfonate (PFBS, C4-S)*
    - *Perfluorohexane sulfonate (PFHxS, C6-S)*
    - *Perfluorooctane sulfonate (PFOS, C8-S)*

2009-10 DEP Study (continued)

- PFCs detected in 67% of samples (≥ 0.005 µg/L; 5 ng/L).
  - Between 1 and 8 PFCs found in these samples.
  - PFOA: Most frequently detected (55% of samples); up to 0.1 µg/L (100 ng/L) .
  - PFNA: More frequent & higher levels than reported elsewhere.
  - Potential sources identified at some sites and unknown at others.
- Final DEP report (posting in progress): *Occurrence of Perfluorinated Chemicals in Untreated NJ Drinking Water Sources (NJDEP, 2014).*
- *Post, G.B., Louis, J.B., Lippincott, R.L., and Procopio, N.A. (2013). Occurrence of perfluorinated chemicals in raw water from NJ public drinking water systems. Environ. Sci. Technol. 47, 13266-75.*
  - Peer reviewed publication (DEP Office of Science; Nov. 2013).
  - Data from 2009 DEP study, two additional NJ American Water sites, and PFCs in raw versus finished water from 10 sites. Discussion of significance of results.

USEPA Unregulated Contaminant Monitoring Rule (UCMR3)

- Required for all large (>10,000 customers) and a very limited subset of small U.S. public water systems (PWS).
  - Sampling of finished water in 2013-15.
  - 6 PFCs, as well as other unregulated contaminants.

- New Jersey public water systems participating:
  - All 165 large community systems.
  - 13 of ~435 small community and 8 of ~700 non-transient non-community systems.

- Higher Reporting Levels than for other NJ PFC drinking water data from certified laboratories.

- Initial UCMR3 data:
  - PFOA and PFNA found more frequently in finished water from NJ public water systems than nationally.
    - PFNA – Gloucester County.
    - PFOA – Various locations.

Initial Unregulated Contaminant Monitoring Rule 3 Data: New Jersey versus National PFC Finished Water Detections

Compound	*Reporting Level (ng/L)*	*NJ PWS (# Detects)**	*NJ PWS (% Detects)*	*National PWS (# Detects **Other than NJ)***	*National PWS (% Detects **Other Than NJ)***
PFOA (C8)	20	**7/75**	**9.3%**	**19/1405**	**1.4%**
PFNA (C9)	20	**2/75**	**2.7%**	**2/1405**	**0.1%**
PFOS (C8-S)	40	1/75	1.5%	23/1405	1.6%
PFHxS (C6-S)	30	0/75	0%	14/1405	1%
PFBS (C4-S)	90	0/75	0%	1/1405	0.07%
PFHpA (C7)	10	1/75	1.5%	16/1405	1.1%
Any PFC	----------	**11/75**	**14.7%**	**<75/1405*** **	**<5.3%*** **

* New Jersey data as of 4/9/14. 90 of 165 large NJ public water systems (PWS) participating in UCMR3 have not yet reported.

** USEPA data posted online as of 2/14.

*** Actual National # and % detections for "Any PFC" are substantially lower than shown due to detections of multiple PFCs in many PWS.

Summary of Data on PFC Occurrence in New Jersey Public Water Systems (PWS)

- First state to conduct statewide PFC occurrence studies.
  - 2006 and 2009-10 DEP studies.
  - Additional raw and finished water data from sites in DEP studies and other sites, submitted by PWS & others.

- Office of Science PFC database (2006 - present):
  - 69 public water systems.
  - 190 sampling locations.
  - 627 samples.
    - 269 raw water; 358 finished water.
    - 374 samples: PFOA & PFOS only.
    - 253 samples: Broader suite of PFCs.

- PFOA detected above NJ guidance (40 ng/L; 0.04 µg/L) in at least one finished water sample from 8 PWS, up to 100 ng/L (0.1 ug/L).

- Additional data from UCMR3.

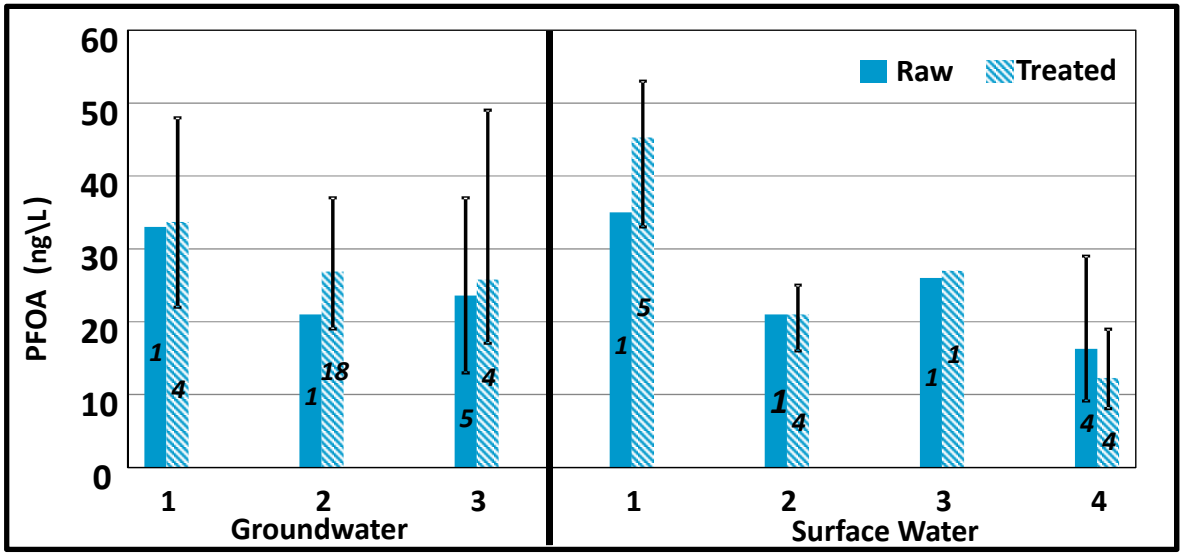
PFCs in Raw versus Finished Drinking Water

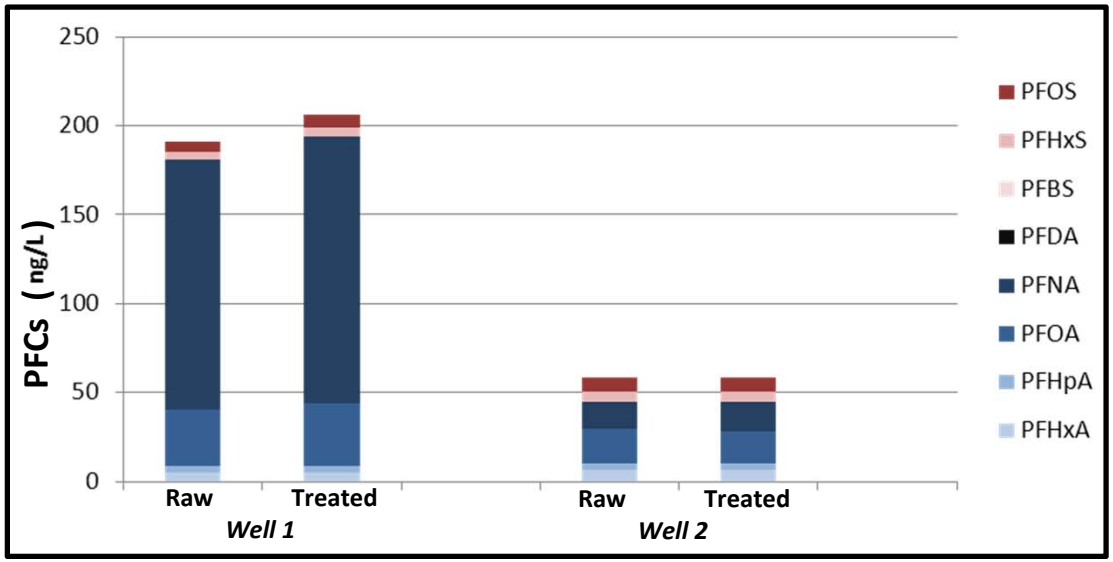
Scientific literature and New Jersey PWS data show that PFCs are:

- Not removed by conventional drinking water treatment processes.
  - Raw water is a good indicator of finished water.

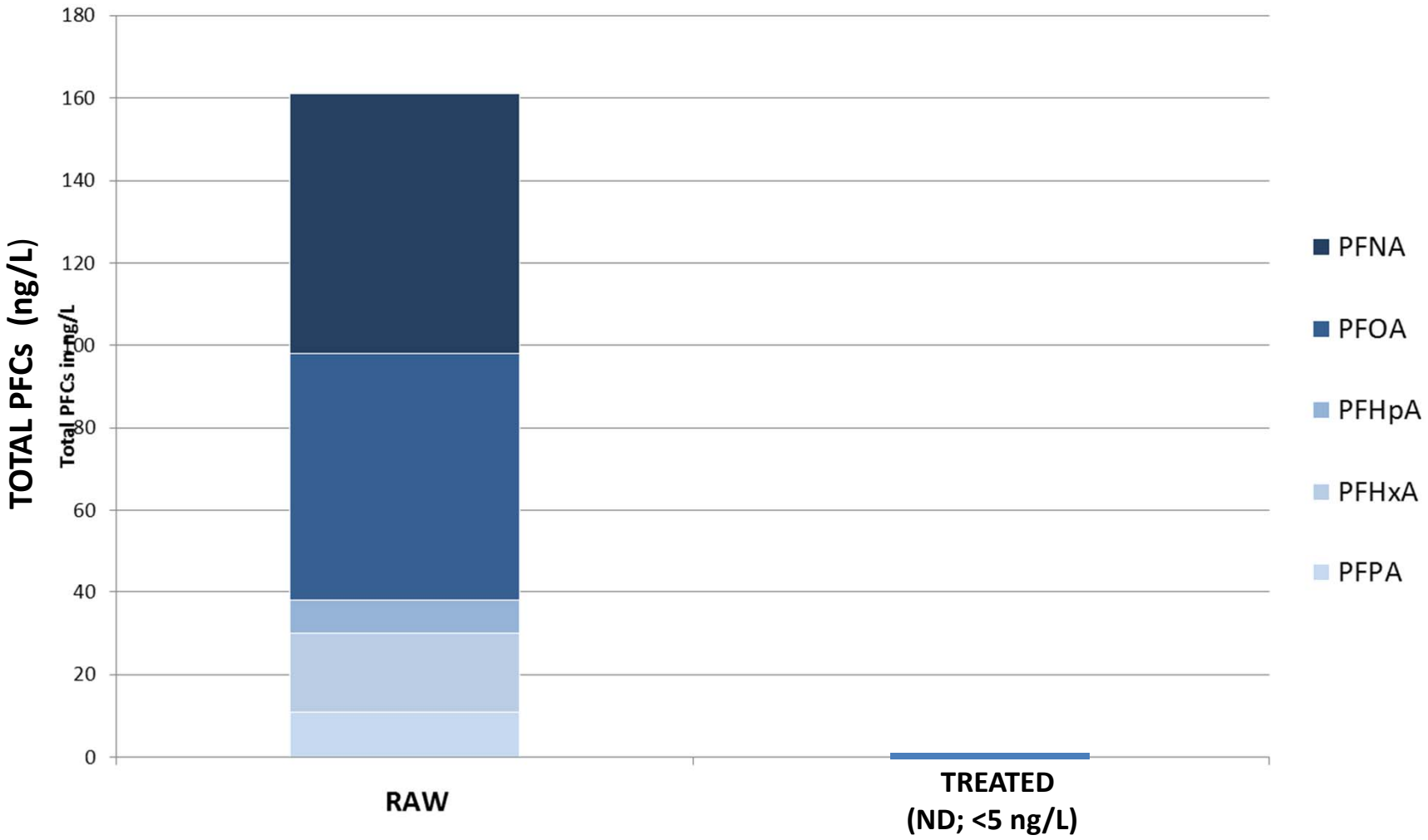
- Can be removed from drinking water by treatment systems specifically designed for PFC removal.
  - Granular activated carbon.
  - Reverse osmosis.
  - Possibly ion exchange.

PFCs in Raw versus Treated Water in NJ Public Water Systems Without Treatment Designed for PFC Removal





PFC Removal from Groundwater PWS with Granular Activated Carbon Designed for PFCs (NJ American Birch Creek – Logan)



Perfluorononanoic Acid (PFNA, C9)

- Detected in Gloucester County public water systems.
  - More frequently, some at higher concentrations, than elsewhere in U.S. and world.
  - Additional testing (PWS and private wells) to occur.
- Potential industrial source identified.
- Paulsboro – highest concentration, up to 150 ng/L (0.15 µg/L) in finished water.
  - DEP/DOH drinking water consumption advisory for infants/children up to 1 year of age (January 2014).
  - This well is now offline.

Draft PFNA Interim Ground Water Criterion & Practical Quantitation Level (PQL)

- Developed by DEP Office of Science with support from DOH, at request of DEP Site Remediation Program.
  - Posted for public comment March 21, 2014.
  - Public comment period ends May 1, 2014.
- Draft health-based criterion - 20 ng/L (0.02 µg/L).
  - Based on chronic drinking water exposure.
- Draft PQL - 3 ng/L (0.003 µg/L).
- Literature review could be starting point for DWQI evaluation.

Contributors

- Many people have contributed to this work, including current and former members of:
  - *DEP Office of Science*
  - *DEP Bureau of Safe Drinking Water*
  - *DWQI Health Effects Subcommittee*
  - *DEP Environmental Research Library*
  - *DOH Environmental Health Program*

- We appreciate the helpful input and support from colleagues at USEPA, the National Toxicology Program, and other organizations.

Thank you!